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The Global Budget of Bomb Radiocarbon

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We present a self-consistent global budget of bomb radiocarbon. We obtain bomb radiocarbon inventories for the period 1955 through 1990 for the ocean, terrestrial biosphere, troposphere and stratosphere using observations and models. The models we use are a three-dimensional ocean general circulation model, a two-dimensional global atmospheric chemical-transport model, and a terrestrial biosphere model that considers nine carbon pools within each of 13 ecosystem types, plus peat. We find that our estimated global inventory of bomb ^{14}C in 1990 exceeds the bomb ^{14}C production by less than 4%, well within the previously recognized uncertainties in estimates of bomb ^{14}C inventories or production. Hesshaimer et al. (1994) performed a similar analysis using a highly schematic carbon cycle model and concluded that ocean uptake of bomb ^{14}C had been overestimated by approximately 25%. In contrast, we see no reason to attribute any of the remaining minor apparent imbalance in the bomb ^{14}C budget to previously unrecognized deficiencies in ocean models or observations. Our analysis provides no evidence that the global bomb ^{14}C budget demands major revisions in existing estimates for the ocean uptake of bomb radiocarbon or, by implication, of anthropogenic carbon dioxide.

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